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NEWS AND INFORMATION

ANNUAL MEETING

The annual IAOS meeting will be held during the 2007 Society for American Archaeology meetings in Austin, Texas. Please join us on Friday, April 27, 2007 from 3-5pm in Meeting Room 410 at the Hilton, Austin. All are welcome to attend!

CONSIDER PUBLISHING IN THE IAOS *BULLETIN*

The *Bulletin* is a twice-yearly publication that reaches a wide audience in the obsidian community. Please review your research notes and consider submitting an article, research update, or lab report for publication in the IAOS B*ulletin*! Articles and inquiries can be sent to cdillian@princeton.edu Thank you for your help and support!

CALL FOR NOMINATIONS

It's time to elect a new IAOS President. Our current President's term ends this year. We will appoint a new President at our next annual meeting at the 2007 Society for American Archaeology meetings in Austin, Texas, for a two year term. Responsibilities include chairing the IAOS annual meeting at the SAAs and working with other officers to manage IAOS business activities. In addition, the President, working with the IAOS board, has wide latitude in shaping the role that IAOS plays in the field of obsidian studies.

Deadline for nominations is April 1, 2007. Nominations may be sent via email or regular mail to the Secretary/Treasurer, S. Colby Phillips at colbyp@u.washington.edu.

Emerging Elite Economies: Formative Period Obsidian Distribution in the Belize River Valley

Kimberly M. Kersey
Winner of the 2006 IAOS Student Paper Award

Introduction

The Middle to Late Formative Period (1000 B.C. to A.D. 300) in Mesoamerica marks a time of growing interaction between many groups and communities. In the Maya Lowlands, this temporal frame is characterized by settlement expansion, population integration, and participation in inter-regional trade and exchange networks of non-local or "exotic" goods, technology, and symbols. Emerging social complexity is also evident in the form of labor investments in construction programs, the differential accumulation of "wealth," and implementation of an iconography of authority.

Although Formative Period deposits are often concealed by later Classic period constructions in many instances, a great deal of information has been amassed through recent excavations in the Belize River Valley. Of special note, investigations of Formative Period deposits at the sites of Blackman Eddy (Brown 2003; Garber et al. 2004a) and Cahal Pech (Awe 1992; Cheetham 1995, 1996; Garber 2006; Garber et al. 2004a) reflect developmental sequences with evidence of emerging elitism and other elaborate socio-cultural manifestations, including participation in long-distance trade networks, as early as the Middle Formative Period. By defining these elements of Formative occupations — specifically through identifying construction sequences, architectural elaborations, shared iconography, and ritual behaviors — the importance of long-distance trade and exchange networks, that resulted in the distribution of exotic items related to "wealth" and prestige, is unquestionable. Additionally, the complexity and organization required for developing and maintaining inter-regional networks has also been linked to the genesis of social complexity during the Formative Period in much of the Lowlands (Adams 1977; Andrews 1983, 1990; Price 1978; Rathje 1971).

The focus of this study was to conduct a diachronic and synchronic investigation of obsidian distribution spanning the entire Formative Period and into the Early Classic at the sites of Blackman Eddy and Cahal Pech. Recent source data of 52 obsidian samples recovered from well-defined Formative Period construction sequences and associated ritual deposits from these sites were used to identify and examine spatial and temporal trends in the distribution of obsidian sources within the Belize River Valley. Chemically "fingerprinting" obsidian samples from Middle and Late Formative Period contexts at Blackman Eddy and Cahal Pech has allowed for an examination of the degree of participation in inter-regional exchange at the community level, accumulation of "wealth" accompanying the emergence of hierarchical social differences, the potential for reconstruction of trade and exchange routes traversing through the Belize River Valley, and an investigation of any local variations in procurement and distribution between these two major centers during this lesser-known era in Mesoamerican prehistory. In addition, by comparing the Blackman Eddy and Cahal Pech data to the available sourcing data from other communities in the Belize Valley, and from other sites in the Lowlands, similarities or inconsistencies in previously observed trends will be further examined.

Obsidian as a Non-Essential Commodity

Obsidian, jade, and marine shell were among the commodities traded or exchanged in relatively small amounts during the Middle Formative Period; the quantity of these goods and likely the frequency of exchange transactions increased during the Late Formative and into the Classic Period. In many early Middle Formative Period contexts, obsidian and other exotic items are often found in association with ritual events such as feasting, dedication, and termination of public structures, as well as interred with the dead, and less often found in domestic contexts. Later in the Middle Formative Period, social hierarchical differences become evident archaeologically by the amount of labor and material invested in construction efforts, coupled with the appearance of public iconographic displays of supernatural and political power, and by a more discreet use of exotic items in private and public ritual. Moreover, increasing social differentiation and complexity appears to also be linked to increasing circumscription of these goods that were used to define authority and rulership during the Maya Classic Period (Freidel 1992; Freidel and Schele 1988a).

Obsidian persisted as a highly valued material as is evident in archaeological contexts, iconography, and ethnohistorical and ethnographic records. Its physical qualities allow for conchoidal fracturing, thus permitting the production of nearly flawless and elegant prismatic blades, made possible through a pressure blade flaking technique. Beyond aesthetics, these prismatic obsidian blades are extremely efficient cutting and slicing tools — although less commonly used in households for such tasks due to limited availability in most cases — and were traditionally used in bloodletting rituals and auto-sacrificial ceremonies as a vehicle to communicate with the supernaturals and aid in transformation (Saunders 2001; Schele and Miller 1986).

Ideologically, the importance of obsidian among Mesoamerican cultures, spatially and temporally, can be interpreted and defined by its geologically localized occurrence in [volcanic] mountains. Mountains were commonly viewed as sacred places of creation, or the *Yax hal witz* (the first true mountain of maize), thereby considered to be the domiciles of the ancestors and supernatural beings, and also directly linked to production of rain-clouds and rain, therefore being directly tied to fertility (Freidel et al. 1993; Reilly 1996; Saunders 2001; Schele 1995). The corpus of sculpture and architecture in early Mesoamerica often depict thematically conservative narratives involving creation and fertility, originating in the natural realm, being reinforced and replicated in the physical realm through bloodletting rituals, abundant re-creations of the sacred mountain theme, and reproduction of the cosmos in architecture and monuments (Ashmore 1991, 1992; Ashmore and Sabloff 2002). Subsequently, by association, obsidian was naturally, symbolically, and cosmologically imbued with the intrinsic power of the sacred mountain and through its use as an apparatus in bloodletting, provided a direct link to the ancestors, the supernatural realm, and fertility.

Obsidian Procurement and Distribution

Obsidian was quarried from several distant volcanic mountain locales and arrived in the Maya Lowlands as a result of extensive networks of inter-regional trade and exchange. Research has indeed shed light upon the nature of the Mesoamerican economy, though it has become clear the inherent complexities of inter-regional exchange systems, especially when considering native economic systems, are often driven by a set of different forces (i.e., distinct ideologies, worldview, religion) thus creating a supply and demand set apart from those participating in, for example, a capitalist economy. Moreover, the inherent complexities are illuminated when the logistical mechanisms of transport, complex networks of relationships established through trade and exchange, and factors of socio-political, economic, and religious organization are taken into consideration (Fowler et al. 1989). However, through refined procedures of chemical analyses (e.g., neutron activation analysis and X-ray fluorescence), the association of obsidian artifacts to their places of origins has been made possible with near 100% certainty (Asaro et al. 1978; Cobean et al. 1991; Glascock et al. 1994, 1998, 1999), therefore adding an essential element to the study of obsidian procurement and distribution.

Through previous source analyses, three major obsidian sources in the Guatemalan highlands — El Chayal, San Martin Jilotepeque (also referred to as Río Pixcaya in the literature), and Ixtepeque — have been identified as the primary sources supplying obsidian in the Maya Lowlands, and were acquired through complex networks transporting goods by overland, riverine, and coastal routes over 500 km from the source (Dreiss 1989; Dreiss and Brown 1989; Nelson 1985; 1989). Obsidian from other sources in Mexico, Honduras, and Nicaragua, has also been identified in the Lowlands, although in relatively lower frequencies. From these initial analyses, a general diachronic and synchronic framework of inter-regional obsidian procurement and distribution over time has been established.

Consequently, the growing set of provenience data have created additional avenues for intra-site and inter-site distribution studies (Awe et al. 1996; Dreiss 1989; Dreiss and Brown 1989; Guderjan et al. 1988, 1989; McKillop 1989), contextual analyses (Fowler et al. 1989; Hammond et al. 1984; Hurtado de Mendoza 1989; Moholy-Nagy 1989; Rice 1983; Rice et al. 1985; Sheets 1975), and typological analyses (Awe and Healy 1994; Clark 1987; Lewenstein 1981; 1989; Moholy-Nagy et al. 1984). The work presented here is built upon certain elements of previously proposed models, and the data presented in this study are also an extension of the growing data set and a contribution to the study of obsidian trade and exchange in the Maya Lowlands.

Blackman Eddy Obsidian Samples by Temporal Affiliation and Context					*Number of Obsidian Samples by Source*					
		Context								*Total per temporal unit*
Temporal Affiliation	*Ceramic phase*	*ritual*	*domestic/ public*	*Total per context*	*San Martin Jilotepeque*	*El Chayal*	*Ixtepeque*	*Unknown*	*Total per source*	
	Transitional Kanocha	5			5					
Early Middle Formative	to EJC			5 (100%)					5 (100%) SMJ	5 (12%)
	Early Facet Jenney								4 (80%) SMJ;	
Early Middle Formative	Creek		5	5 (100%)	4			1	1 (20%) UNK	5 (12%)
									16 (88%) SMJ;	
Transitional EMF to	Transitional EJC to	10		10 (56%)	10				1 (5.5%) EC;	
LMF*	LJC*		8	8 (44%)	6	1	1		1 (5.5%) IXT	18 (42%)
Transitional LMF to	Terminal Late Facet	2		2 (22%)	2					
Late Formative	Jenney Creek		7	7 (78%)	7				9 (100%) SMJ	9 (21%)
Late Formative to Early	Transitional Barton									
Classic	Creek to Hermitage		3	3 (100%)		3			3 (100%) EC	3 (7%)
		2				2				
Early Classic	Hermitage			2 (100%)					2 (100%) EC	2 (6%)
Totals		19 (45%)	23 (55%)	**42 (100%)**	34 (81%)	6 (15%)	1 (2%)	1 (2%)	**42 (100%)**	**42 (100%)**
*EMF = Early Middle Formative Period; LMF = Late Middle Formative Period										
**EJC = Early Facet Jenney Creek; LJC = Late Facet Jenney Creek										

Table 1. Blackman Eddy obsidian source data by temporal affiliation and context.

Additional Sample Data and Preliminary Results of Obsidian Sourcing

Fifty-two obsidian samples recovered from Formative period deposits were submitted to Dr. Michael Glascock at the (MURR) Archeometry Laboratory for source analysis using instrumental neutron activation analysis (INAA). Chemical sourcing via short-irradiation instrumental neutron activation analysis (INAA) resulted in the positive source identification of 51 of the 52 samples submitted for the elemental source analysis. The one sample from Blackman Eddy, unable to be sourced by the short-irradiation method, was submitted for long-irradiation analysis of which results are still pending, but upon initial observation, Glascock (2006 personal communication) favors origin from a Honduran or Central Mexican source.

Forty-two obsidian samples were selected from Blackman Eddy, which represents 21% of the total obsidian assemblage from Structure B1. Nineteen (45%) of the 42 samples from Blackman Eddy were recovered from ritual deposits while the remaining 23 (55%) were recovered from well-defined construction sequences. Overall, a total of 37 obsidian artifacts (88%) are from the four Formative period intervals, while the remaining 5 obsidian samples (12%) were recovered from the transition Late Formative/Early Classic period deposits and Early Classic period deposits exclusively. The sourcing data from Blackman Eddy represents the largest single dataset of sourced obsidian from one locale in the Belize

Valley; prior to this study, no obsidian from Blackman Eddy has been chemically sourced. These data will not only substantially increase the dataset for the Belize River Valley, but may also illuminate any minor intricacies not visible in smaller sampling arenas.

A total of 34 obsidian artifacts were recovered from Cahal Pech Plaza B trench excavations in 2004 and 2005. Of the 34 samples, 10 obsidian artifacts were recovered from Formative Period deposits which represents 30% of the total obsidian recovered. Five (50%) of the 10 obsidian samples were recovered from ritual/burial deposits while the remaining five (50%) obsidian artifacts were recovered from associated fill from sequential construction phases. In addition to the source data from these 10 obsidian samples, previous sourcing data from Cahal Pech (Awe et al. 1996) will also be examined.

Upon initial observation of the sourced obsidian data, it is obvious that an overwhelming majority of obsidian from Blackman Eddy originated from the San Martín Jilotepeque source (Table 1). Interestingly, however, a majority of obsidian from the same temporal sequence at Cahal Pech originated from the El Chayal source; the overwhelming majority of El Chayal obsidian at Cahal Pech has also been documented by Awe et al. (1996) (Table 2).

a. Cahal Pech Plaza B Obsidian Samples by Temporal Affiliation and Context				*Number of Obsidian Samples by Source*						
		Context								
Temporal Affiliation	*Ceramic phase*	*ritual/ burial*	*domestic/ public*	*Total per context*	*San Martin Jilotepeque*	*El Chayal*	*Ixtepeque*	*Unknown*	*Total per source*	*Total per temporal unit*
Transitional Early Middle Formative to Late Middle Formative Periods	Transitional Early Facet to Late Facet Jenney Creek	5		5 (100%)	1 (20%)	3(60%)	1(20%)		1(20%) SMJ; 3 (60%) EC; 1 (20%) IXT	5 (50 %)
Late Formative Period	Xacal/Barton Creek		5	5 (100%)	1 (20%)	3 (60%)	1(20%)		1 (20%) SMJ; 3 (60%) EC; 1 (20%) IXT	5 (50%)
Totals		5 (50%)	5 (50%)	**10 (100%)**	2 (20%)	6 (60%)	2 (20%)		**10 (100%)**	**10 (100%)**

b. Cahal Pech Structure B Obsidian Samples by Temporal Affiliation and Context			*Number of Obsidian Samples by Source*					
Temporal Affiliation	*Ceramic Phase*	*Total*	*San Martin Jilotepeque*	*El Chayal*	*Ixtepeque*	*Unknown*	*Total per source*	*Total per temporal unit*
Terminal Early Formative Period	Transitional Cunil to Early Facet Jenney Creek	7		7 (100%)			7 (100%) EC	7 (54%)
Transition Early Middle Formative to Late Middle Formative Periods	Transitional Early Facet to Late Facet Jenney Creek	3	2 (66%)	1 (34%)			2 (66%) SMJ; 1 (30%) EC	3 (23%)
Late Formative Period	Xacal/Barton Creek	3	2 (66%)	1 (34%)			2 (66%) SMJ; 1 (30%) EC	3 (23%)
Totals		**13 (100%)**	4 (31%)	9 (69%)			**13 (100%)**	**13 (100%)**

Table 2. Cahal Pech obsidian source data by temporal affiliation and context.

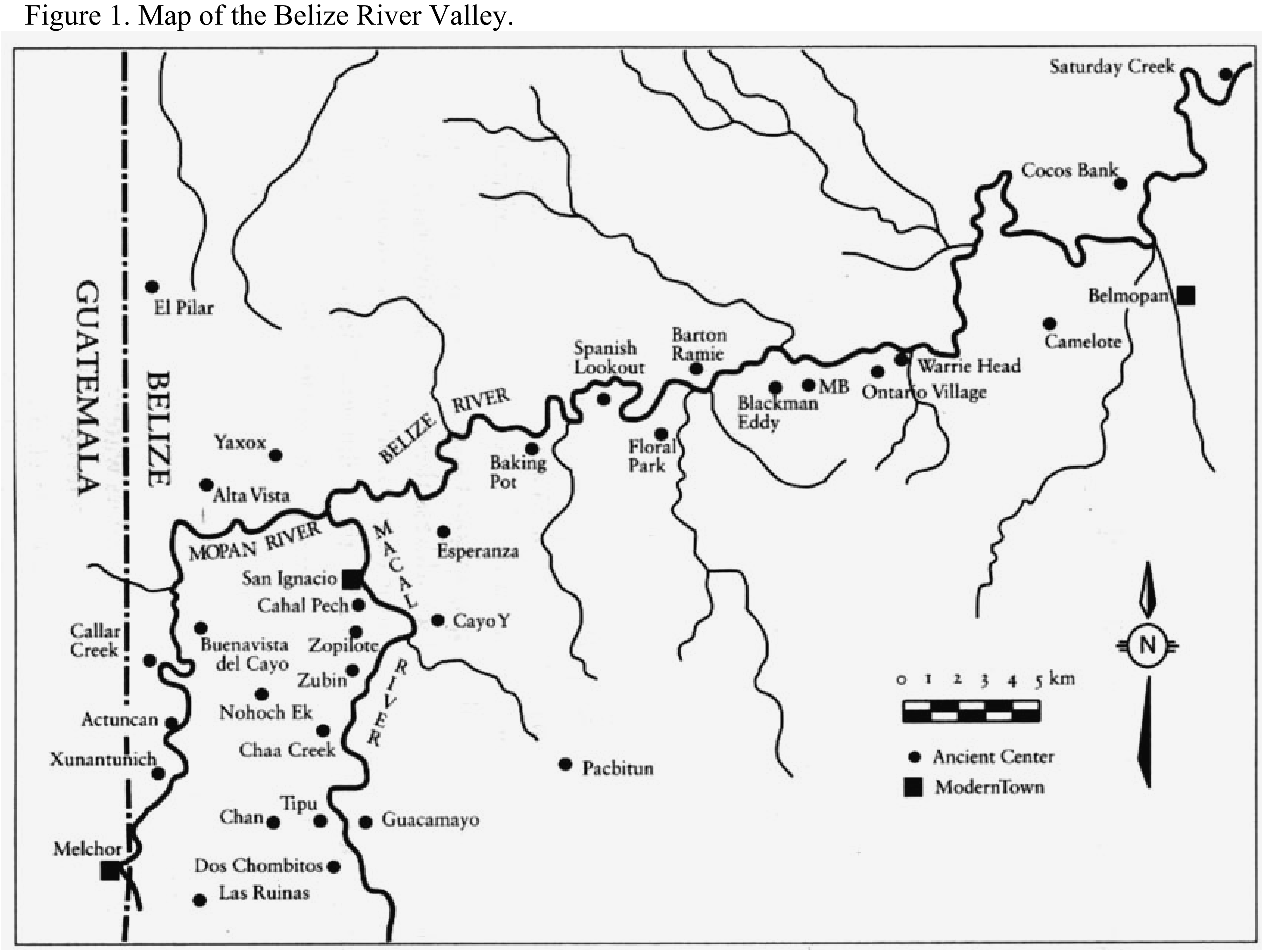
Blackman Eddy: Temporal Distribution, Context, and Raw Material Source

Of the 283 obsidian artifacts recovered from the site of Blackman Eddy, 217 (77%) were recovered from excavations in Structure B1 alone. The large number of obsidian found in Structure B1 is not surprising because this structure was a major focal point of a variety of integrative activities over the entire span of occupation — first as a household, then for public ritual and civic gatherings, and finally as the locale for more private elite ritual and ceremony (Brown 2003; Garber et al. 2004a, 2004b). Furthermore, much more of the structure was excavated compared to other structures at the site (Figure 1). As noted before, 42 samples (or 21%) were selected from the Structure B1 assemblage for chemical source analysis.

Transitional Kanocha to Early Facet Jenney Creek Phase (ca. 1000/900 B.C. to 850 B.C.)

The earliest deposits containing obsidian at Blackman Eddy date to the Early Middle Formative Period associated with the transition from Kanocha phase ceramics to the early facet Jenney Creek phase ceramics (ca. 1000/900 B.C. to 700 B.C.). Attesting to participation in the established networks of inter-regional exchange at this early date, other exotics such as greenstone and numerous marine shells have also been found during this early period. A number of obsidian blades fragments were recovered—5 of which were submitted for sourcing. All five blades were sourced to San Martín Jilotepeque.

Figure 1. Map of the Belize River Valley.



The Kanocha phase and early facet Jenney Creek phase deposits at Blackman Eddy overall reflect a developmental sequence beginning with the raising of perishable domiciles to the construction of simple masonry architecture and lime-plaster plaza floors atop bedrock. With the increased labor investment evident in these construction efforts, ritual feasting of a variety of animal foods, the use of pan-Mesoamerican iconographic emblems, and the presence of exotic items, the first materializations of a communal identity is visible at Blackman Eddy during this phase (Brown 2003:111).

The presence of obsidian blades in these early Middle Formative contexts may signify the earliest use of obsidian blades in the Maya Lowlands to date (Brown, personal communication). Interestingly, very few obsidian blades were found in the earliest occupation levels at Cahal Pech; rather, numerous obsidian flakes were present. Based on this observation, Awe and Healy (1994) suggest that a developmental sequence from a flake to a blade industry in the Belize Valley was likely during the Middle Formative (Awe and Healy 1994). Additionally, Clark (1987) argues that spread of obsidian blade technology “appears to have followed the emergence of complex chiefdoms in any given region, suggesting that its spread was not due solely to the technical efficiency of blades” (1987:260). Obsidian blades have been recovered from the early Middle Formative Period deposits when Blackman Eddy appears to have been an emerging egalitarian society focused on “communal” construction efforts and public ritual feasting, rather than a complex chiefdom. However, its strategic location near the navigable Belize River and established trade routes inland from the coast may have facilitated access to the technology or the blades themselves, as well as access to other goods. These favorable circumstances may have allowed the inhabitants of Blackman Eddy to accumulate wealth which may have contributed to their emergence as a seat of power in the valley later in the Middle Formative. Conversely, Cahal Pech appears also to be strategically located (only 5 km) from the confluence of the Mopan and Macal Rivers (that form the Belize River; see Figure 1), but a majority of the obsidian assemblage consists of flakes rather than blades. This may be a reflection the differences in local redistribution, differential access to technology, or alternatively, the inhabitants of Cahal Pech were involved in other spheres of trade.

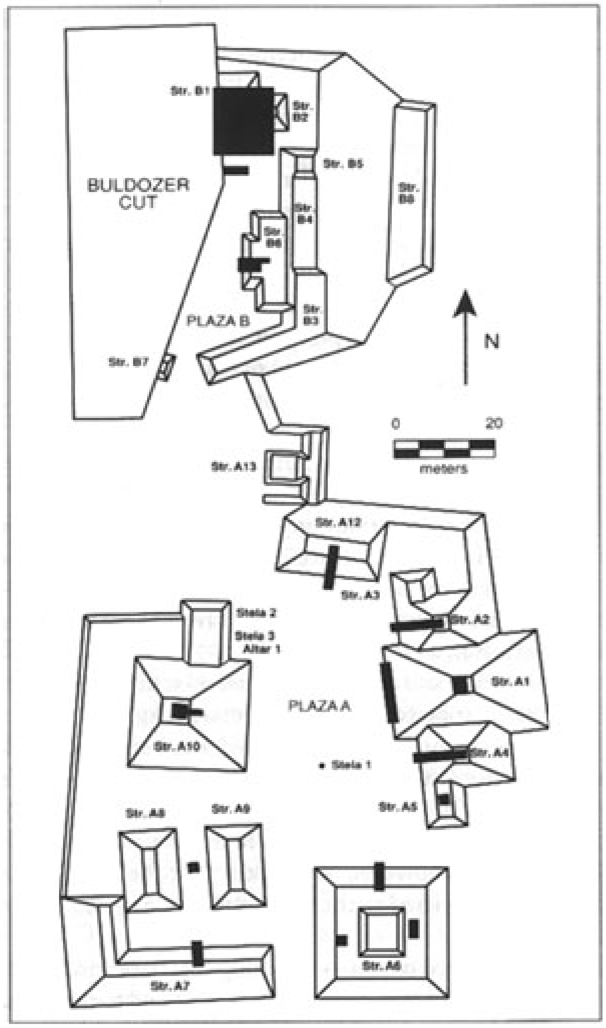


Figure 2. Map of Blackman Eddy site core (from Garber et al. 2005b:50).

Early Facet Jenney Creek (850 B.C. to 650 B.C.)

The initial rectangular platform constructions, Structure B1-7th and B1-6th, mark the first appearance of public structures and obvious “community” expression, as well as evidence of a substantial increased labor investment (Brown 2003:114). Extended over a wide area just west of the platforms was associated ritual debris, the remnants of possible feasting events. The

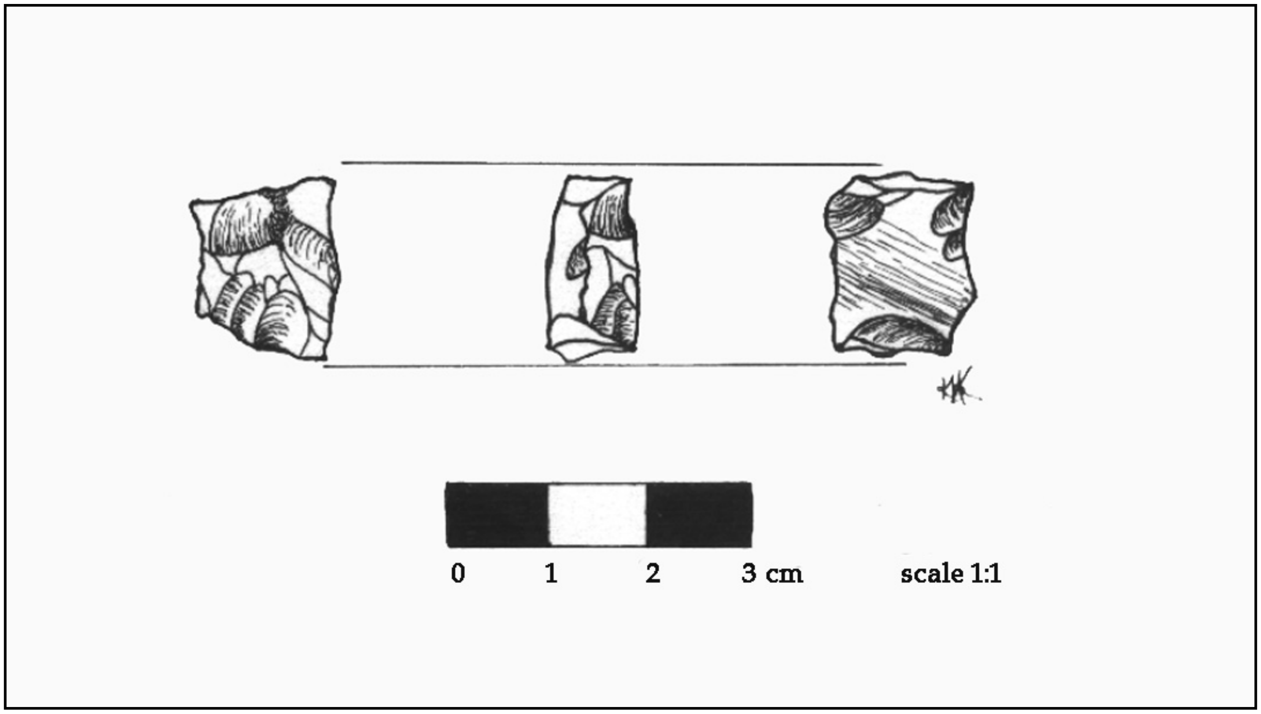


Figure 3. Possible biface fragment from an unknown obsidian source, Blackman Eddy (illustrated by the author).

communal ritual feasting events, visible here at Blackman Eddy, are part of a larger spatial pattern that characterizes much of the ritual behavior during the Middle Formative Period (Garber et al. 2005a). A total of five obsidian samples were recovered in the construction fill of these early platforms. All but one of the obsidian samples have been sourced to San Martín Jilotepeque.

The one sample representing the unidentified source in either Honduras or Central Mexico is a possible biface fragment found in construction fill also related to the first phases of platform construction during this time. Morphologically, the fragment is interesting because it has a series of small negative flaking scars characteristic of the final stages of biface thinning on the ventral side. The dorsal side is characterized by a semi-concave to flat plane that exhibits no evidence of flake removal and it has no finished edge or evidence of use-wear along any edge; the edges are thick and irregular as if it was a mid-section ventral surface fragment belonging to a larger chipped stone implement (Figure 3). These characteristics and breakage patterning suggest that this fragment may have been part of a complete chipped stone tool or eccentric that was intentionally, not naturally, smashed. At Blackman Eddy, evidence of ritual destruction of chipped stone items is found within a ritual deposit placed in a shell-lined basin-shaped depression cut into bedrock (BR-F2) (Brown 2003:116–118; Garber et al. 2004a:37). Destruction of cultural materials for ritual purposes is narrated in the *Popol Vuh* (Tedlock 1985), and is a common practice evidenced by remains of Late Formative Period and Classic Period dedicatory termination ritual events (Garber 1983).

Transitional Early Facet Jenney Creek/Late Facet Jenney Creek (650 B.C. to 300 B.C.)

Four complete blades and 14 blade fragments are associated with this phase. Seven of these obsidian samples were recovered from ritual deposits associated with the construction of Structure B1-5th; and 3 are affiliated with the construction and dedication of Structure B1-4th. The remaining eight obsidian artifacts were recovered from fill within these constructions. Sixteen of the obsidian samples (88%) were derived from the San Martín Jilotepeque source. El Chayal and Ixtepeque are represented by one sample each, collectively forming 12% of the sourced obsidian from this period.

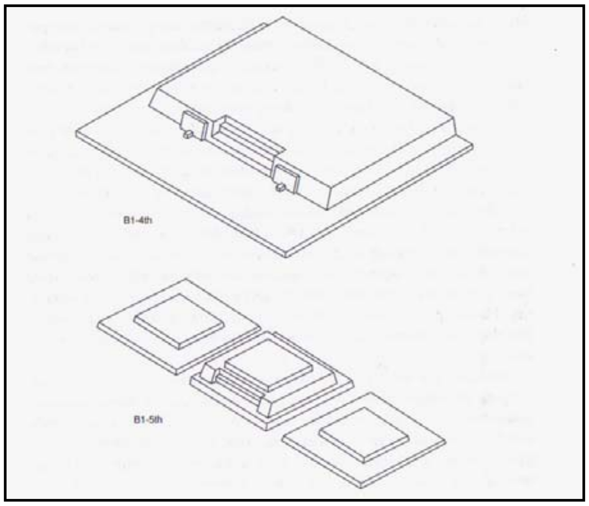


Figure 4. Reconstruction of Structures B1-5th and B1-4th, Blackman Eddy (from Garber 2004a:39).

Rather dramatic social changes, with signals of emerging elitism, occurs at Blackman Eddy during this temporal interval as suggested by increased wealth evident in labor investment, elaborate architecture, and inventory and nature of ritual deposits. This is first documented with the construction of Structure B1-5th (Figure 4), a triadic arrangement of three platforms, and indicates a higher level of architectural elaboration than previous structures (Garber et al. 2005:38). The triadic arrangement of Structure B1-5th also suggests the physical manifestation of the "Three Stone Place" of creation at the base of the "first true mountain of maize," or *Yax hal witz* (Brown 2003:124). Thematically, this representation of the "Three Stone Place" of creation is one of numerous examples documented architecturally and iconographically throughout Formative Period Mesoamerica.

The trajectory of architectural elaboration at Blackman Eddy continues with the construction of a larger single-tiered rectangular platform with an inset staircase and extended basal platform (B1-4th). In addition, decorative elements such as stucco façade masks were put in place along the basal platform (see Figure 4), which marks the earliest documented use of architectural masks in the Lowlands to date (Brown 2003:134; Garber et al. 2004a:42). Architectural façade masks are common in Late Formative construction programs and are interpreted as a mode of communication about worldview, the social order, and the supernatural, which would have been recognizable by those participating in inter-regional interaction spheres during the Late Formative Period (Freidel 1979). Furthermore, it is suggested by numerous scholars that the mask tradition not only expressed a powerful worldview, but also communicated aspects of the social order and legitimized the development of early kingship within society (Freidel and Schele 1988; Garber et al. 2004a, 2004b; Hansen 1992). This discovery of façade masks during the Late Middle Formative at Blackman Eddy may suggest that Late Formative and Classic architectural decoration evolved out of this earlier mask tradition and that "the material symbol system of kingship had antecedents in the Middle [Formative]" (Brown 2003:138).

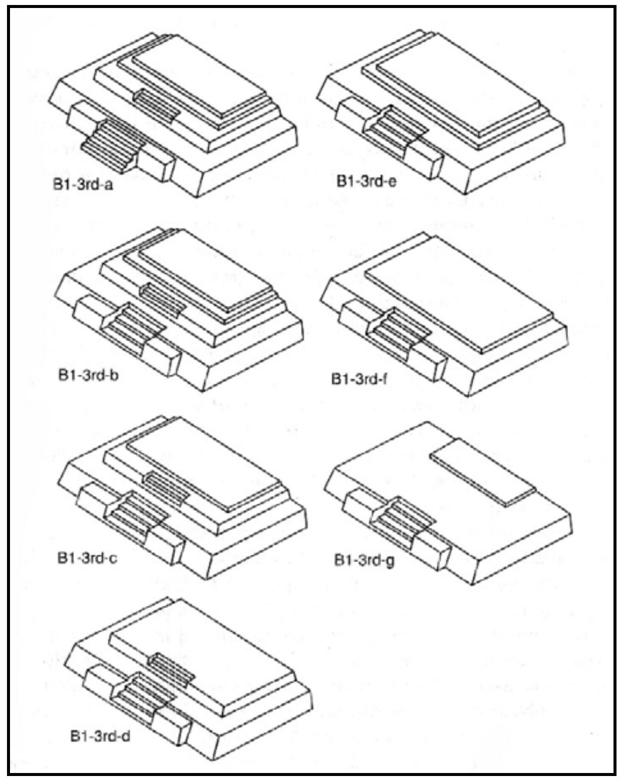


Figure 5. Reconstruction of Blackman Eddy Structures B1-3rd-g through B1-3rd-a (from Garber 2004a:43).

Terminal Late Facet Jenney Creek (ca. 300 B.C.)

Nine obsidian samples are associated with the Terminal Late Facet Jenney Creek phase. This grouping of sourced obsidian was recovered from the subsequent construction phases of Structure B1, designated as B1-3rd-g, B1-3rd-f, and B1-3rd e (Figure 5). All of the obsidian associated with this phase originated from the San Martín Jilotepeque source.

Six phases of construction (B1-3rd-a through B1-3rd-g), defined by the various architectural elaborations and construction techniques, span the Late Middle Formative to the Late Formative Periods. The shift in architectural style and materials occurs after Structure B1-4th was burned and desecrated signifying possible evidence of hostile acts or warfare (Brown 2003:157; Brown and Garber 2003; Garber et al. 2004a:42). Subsequently, these six phases of construction doubled the height of the B1-3rd over time and added an outset staircase by the final construction phase of B1-3rd-a. Within the construction fill of B1-3rd-g, five of the sourced obsidian blade fragments were recovered. A total of three ritual deposits are affiliated with B1-3rd-g construction and are possibly associated with the dedication of an additional summit platform. Above these deposits was another modest dedication of a carved shell pendant, complete blade (broken into halves) of San Martín Jilotepeque obsidian, deposited within the fill of the platform.

Beyond the rather intense construction programs initiated during this time at Blackman Eddy, other changes occur in the valley and in the Lowlands as a whole. These changes are characterized by population increase and integration, settlement expansion, and increase in trade of items such as obsidian, marine shell, and greenstone. Consequently, the upper class of Blackman Eddy appears to be accumulating a fair amount of the wealth indicated by the increased quantity of exotics, labor investment in construction efforts, and assertions of a degree of central authority present in architectural elaborations during this time. Garber et al. (2004a:44) note "the picture that emerges for late Jenney Creek phase culture in the valley is one of a precocious society" with Blackman Eddy possibly emerging as a seat of power in the Belize River Valley.

Transitional Barton Creek/Mount Hope to Hermitage phase (350 B.C. to A.D.300)

Three blade fragments in the sourced obsidian assemblage represent the transitional Barton Creek/Mount Hope to Hermitage ceramic phases during the Late Formative to Early Classic Periods. All blade fragments are from El Chayal obsidian.

The later subphases of B1-3rd construction signal a change in architectural style to more of a pyramidal form as well as indicate change in ritual behavior from a more open communal expression (i.e., ritual deposits scattered on the surfaces of structures) to a more restrictive private form of ritual (i.e., caching in more defined and secluded niches of the structures) (Brown 2003:139). Surrounding communities in the Belize Valley (e.g., Cahal Pech, Pacbitun, El Pilar, Buenavista del Cayo, and Actuncan) were also implementing construction programs for development of ceremonial precincts during the Middle to Late Formative. Brown (2003:142) interprets the several phases of construction to Structure B1-3rd may indicate the inhabitants of Blackman Eddy might have been struggling to compete for power with these neighbors and validated their authority through architectural height and elaboration. Shifts in architectural style and ritual behavior during this time begin to mirror Classic Period forms of architecture and ritual practice that signify association with the institution of kingship that defines the later Classic Maya civilization (Demarest 1992; Freidel 1977, 1992; Freidel and Schele 1988a; Garber et al. 1998; Grove and Gillespie 1992; Ringle 1999). These shifts from "communal" identity to more "private" personas evident in architecture and ritual behavior further suggest the emergence of an elite class, increasing status differentiation between members of the community, and attest to increasing social complexity.

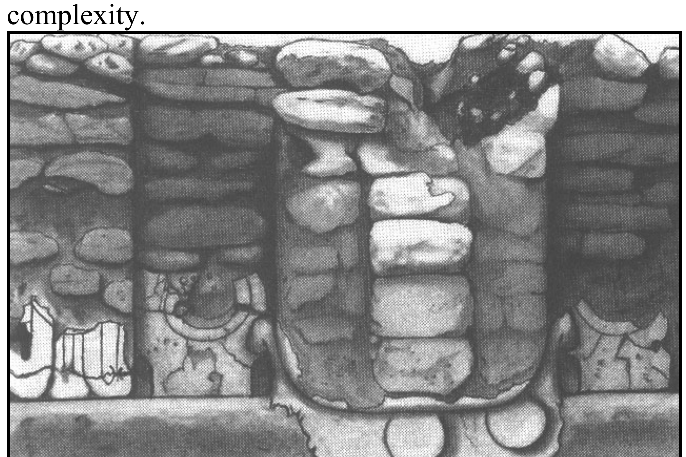


Figure 6. Blackman Eddy Structure B1-2nd façade mask (from Garber et al. 2004b:56).

By the end of the late Formative Period, initial construction of Structure B1-2nd was complete. Structure B1-2nd was composed of two-tiers reaching a height of 3.4m, an addition of a central outset staircase, and stucco façade masks on the lower and upper tiers of the structure. The central section of the mask represents the head of a long-nosed deity flanked on each side by panels with circular partially preserved decorative ear-flares. The head is resting in an outwardly flaring bowl, shown in profile, and adorned with three large dots (Figure 6). The bowl functions symbolically as a "bloodletting bowl" and is viewed as a portal defining the liminal space between the natural and supernatural worlds while the three dot adornment symbolizes the "Three Stone Place" of creation (Garber et al. 2004b, 2005). This iconographic composition may further reiterate the Popol Vuh story of the severed head of the father of the Hero twins emerging from a blood bowl. This theme has also been represented symbolically in Burial 1 from Plaza B at Cahal Pech, which will be discussed momentarily. These further elaborations of Structure B1 define an important element of the functioning ceremonial precinct at Blackman Eddy that was constructed to replicate the cosmological order. In other words, Structure B1 became a sanctified location with adequate staging areas for shamanic performance and re-enactments of the creation story complete with iconographic façade decorations "serving to fuse cosmology and myth into an architectural display of supernatural and political power" (Garber et al. 2004b:54).

Hermitage phase (A.D. 300 to A.D. 600)

Two blade fragments, of El Chayal obsidian, are associated with Structure B1-2nd-a, and possibly with ritual activity, during the Hermitage ceramic phase of the Early Classic Period. Numerous pieces of obsidian were recovered from the later construction phases of Structure B1. However, due to architectural slump and recent destruction, the exact temporal affiliations could not be determined.

Cahal Pech Obsidian: Temporal Distribution, Context, and Raw Material Source

A total of 34 pieces obsidian have been recovered from recent trench excavations in Plaza B at Cahal Pech (Figure 7). Ten of these obsidian artifacts were recovered from well-defined Formative Period ritual deposits and construction sequences sealed under Classic Period plaza floors. The remaining 24 are associated with Classic Period plaza floor construction episodes. Sourcing data from previous excavations of Structure B4 (Awe et al. 1996) will also be combined with the most recent sourcing data.

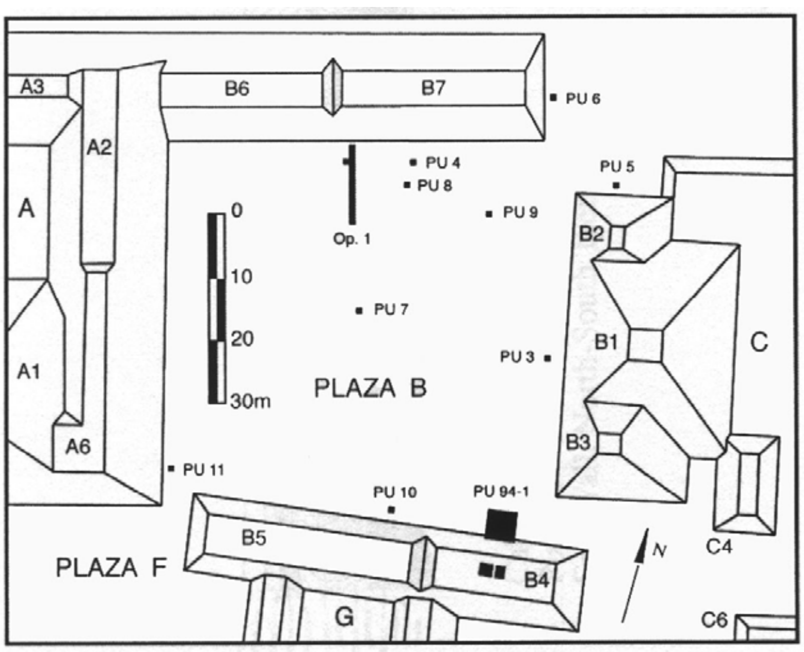


Figure 7. Map of Cahal Pech site core.

Transitional Cunil to Early Facet Jenney Creek phase (1100/1000 B.C. to 900 B.C.)

The appearance of Cunil phase ceramics at Cahal Pech marks the earliest occupation sequence established atop bedrock (Awe 1992). During previous investigations of Structure B-4 (at the southern end of Plaza B; see Figure 7), a total of 28 obsidian pieces were recovered from the transitional Cunil to Early Facet Jenney Creek (Kanluk) phase. However, the exact details of artifact types were not available. Based on previous observations, it is likely that a majority of these obsidian artifacts were flakes (Awe 1992; Awe and Healy 1994; Cheetham 1995, 1996; Healy 1999). Seven obsidian artifacts (25% of the total obsidian recovered) from the transitional Cunil to Early Facet Kanluk phase in Structure B-4 were sourced to El Chayal (Awe et al. 1996; see Table 2, b).

Transitional Early Facet Jenney Creek to Late Facet Kanluk phase (700 B.C.)

A total of one complete blade, two blade fragments, and two flakes were recovered from early to late Middle Formative deposits associated with transitional early to late facet Jenney Creek (Kanluk) phase ceramics. All common highland Guatemalan obsidian sources are represented in the sample and consist of: one blade fragment of San Martín Jilotepeque obsidian; the single complete blade, one blade fragment, and one flake of El Chayal obsidian; and one flake representing the Ixtepeque source (see Table 2, a). The two blade fragments and two flakes are associated with Floor 4 of Plaza B which was an artifact-laden lens (ranging from 5 to 20 cm in thickness) that extended rather consistently through the entire excavation trench. The possibility that this dense artifact zone represents ritual feasting events is likely and detailed analysis is in progress (Garber et al. 2005).

During trench investigations in Plaza B in 2004, three platform structures (A, B, C), associated with early facet Jenney Creek phase material, were discovered. The precise north to south dimensions of Platform C are not known due to limited exposure of the trench excavation but the southeastern corner of Platform B was revealed during the 2005 investigations indicating a total length exceeding 15 meters. Burial 1 was discovered at the southernmost corner of Platform B. A human skull and six polished greenstone beads were found inside a large red bowl (type variety currently under analysis), located directly under a very large limestone slab that formed the exact corner of Platform B. The body (separated, but assumed to belong to the head) extended with the feet pointing to the north-northwest closely aligned with the axis of Platform B. Associated grave goods consisted of a small groundstone "cone," shell tinklers, and a single El Chayal obsidian blade.

The head-in-bowl composition may symbolically represent the episode in the Popol Vuh of the Hero Twins planting their father's decapitated head which in turn sprouts into a maize plant. The head-in-bowl symbolism manifested here during the early Middle Formative also resonates with later iconographic themes used in architectural displays of supernatural and political power such as the stucco masks decorating the facades of many Late Formative period structures, including Structure B1 at Blackman Eddy.

Three out of four obsidian artifacts recovered from early to late Middle Formative Period deposits during previous investigations in Structure B-4 at Cahal Pech were submitted for source analysis (Awe et al. 1996). Two samples were sourced to San Martín Jilotepeque obsidian (66%), and the other was from the El Chayal source (34%). However, this higher percentage of San Martín Jilotepeque obsidian may be a reflection of the small sample size.

Xacal/Barton Creek phase (350 B.C. to 350 A.D.)

Three blade fragments and two flakes were recovered from the Xacal/Barton Creek phase which is temporally assigned to the Late Formative. Similar to earlier phases, all common Guatemalan sources are represented. Two of the blade fragments and one flake are of El Chayal obsidian, the other blade fragment is San Martín Jilotepeque obsidian, and one Ixtepeque flake. This phase was associated with Plaza Floor 3 and consisted of remnants of intact plaster and floor fill approximately 15 to 20 cm thick. Artifacts recovered from this level include: lithic tools, polished and unworked greenstone fragments, numerous marine shell fragments and beads, obsidian blades/flakes, and a slate fragment.

Awe et al. (1996) submitted three (50%) of six obsidian artifacts recovered from Late Formative deposits in Structure B-4 for source analysis. Similar to the Middle Formative obsidian assemblage, San Martín Jilotepeque obsidian was represented by two (66%) of the obsidian samples, while the other sample was from the El Chayal source (see Table 2, b).

Region and sites	*Time period*	*San Martin Jilotepeque*	*El Chayal*	*Ixtepeque*	*Other*	*Total*
Peten						
	Middle Formative	47 (75%)	11 (17%)	3 (5%)	2 (3%)	63 (100%)
Central Peten	Late Formative	22 (65%)	8 (24%)	4 (11%)		34 (100 %)
(Rice et al. 1985)	Early Classic	6 (24%)	18 (72%)		1 (4%)	25 (100%)
El Mirador	Middle Formative	3(100%)				3 (100%)
(Fowler et al. 1989)	Late Formative	4 (24%)	13 (76%)			17 (100%)
La Libertad (Nelson et al. 1978)	Middle Formative	65 (80%)	10 (12%)		6 (8%)	81 (100%)
Peten Lakes sites	Late Formative	69 (71%)	19 (20%)	7 (7%)	2 (2%)	97 (100%)
(Rice 1984)	Early Classic	6 (24%)	18(72%)		1 (4%)	25 (100%)
Seibal	Middle Formative	20 (91%)	2 (9%)			22 (100%)
(Nelson et al. 1978)	Late Formative	18 (86%)	3 (14%)			21 (100%)
Tikal (Moholy-Nagy et	Middle Formative	1 (100%)				1 (100%)
al. 1984; Nelson et al.	Late Formative	20(47%)	9 (21%)	10 (23%)	4 (9%)	43 (100%)
1978)	Early Classic	4 (6%)	41(61%)		22 (33%)	67 (100%)
Belize Valley						
Barton Ramie	Middle Formative	1 (100%)				1 (100%)
(Nelson et al. 1978)	Late Formative	1 (100%)				1 (100%)
Big Falls (Dreiss and Brown 1989)	Late Formative	3 (100%)				3 (100%)
Cahal Pech	Middle Formative	2 (20%)	8 (80%)			10 (100%)
(Awe and Healy 1996)	Late Formative	2 (67%)	1 (33%)			3 (100%)
	Middle Formative		1(100%)			1 (100%)
Pacbitun (Healy 1990)	Late Formative		2 (50%)	2 (50%)		4 (100%)
Vaca Plateau						
Caracol (Dreiss and Brown 1989)	Late Formative		1(33%)	2 (67%)		3 (100%)
Coastal						
Moho Cay (Dreiss 1986; Healy et al. 1984)	Early Classic		13 (81%)	3 (19%)		16 (100%)
Yucatan						
Dzibilnocac (Dreiss and Brown 1989)	Middle Formative	1(100%)				1 (100%)
Edzna (Dreiss and	Middle Formative	12(100%)				12 (100%)
Brown 1989)	Late Formative	11 (27%)	28 (68%)	2 (5%)		41 (100%)
Northern Belize						
	Late Formative		16 (100%)			16 (100%)
Cerros (Nelson 1985)	Early Classic		1 (50%)	1 (50%)		2 (100%)
Chan Chen (Nievens et	Late Formative		1 (100%)			1 (100%)
al. 1983)	Early Classic		2 (50%)	2 (50%)		4 (100%)
Colha (Brown et al.2004;	Middle Formative	22 (67%)	8 (24%)	3 (9%)		33 (100%)
Dreiss 1988)	Late Formative	26 (27%)	37 (39%)	32 (34%)		94 (100%)
Cuello (Hammond 1982;	Middle Formative	4 (100%)				4 (100%)
Hammond 1991:198)	Late Formative		16 (29%)	26 (47%)	13(24%)	55 (100%)
	Middle Formative	1 (25%)	1 (25%)	2 (50%)		4 (100%)
Kichpanha (Dreiss 1988)	Late Formative		1 (50%)	1 (50%)		2 (100%)
Nohmul (Hammond et	Late Formative		2(100%)			2 (100%)
al. 1984)	Early Classic		4 (100%)			4 (100%)
Pulltrouser Swamp	Late Formative	1(33.3%)	1 (33.3%)	1 (33.4%)		3 (100%)
(Dreiss and Brown 1989)	Early Classic		1 (100%)			1 (100%)

Table 3. Summary of available obsidian source analysis data from the Maya Lowlands.

Observed Trends and Comparisons of Obsidian Source Data in the Maya Lowlands

A paucity of sourcing data for the lowland Formative Period has made the investigation of early inter-regional trade and exchange networks a difficult task. Awe and Healy (1996:161) note that the smaller quantity of sourced and dated obsidian from the Formative Period in comparison to obsidian data from the Classic Period, may suggest a more limited incipient obsidian trade or limited access to obsidian sources during this early time. However, it may also be a reflection of the inaccessibility of Formative Period deposits as most are buried deeply under Late Classic constructions.

Nevertheless, through full horizontal excavations of Structure B1 at Blackman Eddy, trench excavations in Plaza B at Cahal Pech, and previous excavations in Structure B-4, a noticeable amount of exotic materials (i.e., obsidian, jade/greenstone, and marine shell) have been recovered from deposits spanning the Terminal Early Formative Period to the Late Formative Period indicating a moderate level of participation in the active inter-regional trade and exchange systems of the time. This early evidence for inter-regional interaction in the Belize River Valley also suggests that long-distance trade and exchange spheres were well-established by the Formative Period in Mesoamerica.

Blackman Eddy and Cahal Pech, as well as many others sites in the Belize Valley, have been the focus of investigations for a greater part of the last 50 years. Consequently, a well-defined chronology based on radiocarbon dates, associated construction sequences, ritual behaviors, and ceramic data has been established. Elemental sourcing of obsidian from Blackman Eddy and Cahal Pech has allowed for another facet of history in this region to be explored. This sourcing data, and associated contextual and temporal data, have aided in the diachronic and synchronic analysis of obsidian distribution from these two sites located in the Belize River Valley. From the obsidian sourcing data presented above apparent differences exist in the percentages of obsidian present at each site. This may suggest that different mechanisms of obsidian distribution, or *redistribution*, were at play in the Belize River Valley.

The high percentages of San Martín Jilotepeque obsidian found at Blackman Eddy in the Middle to Late Formative Periods are congruous with the general pattern of obsidian distribution throughout the Maya Lowlands at the sites of El Mirador, Peten Lakes sites, La Libertad, Seibal, Tikal, and Edzna (see Dreiss 1988; Dreiss and Brown 1989; Fowler et al. 1989; Hammond 1982, 1984; Nelson 1985; Nelson et al. 1978; Rice 1984; Rice et al. 1985) (Table 3). The shift in distribution from San Martín Jilotepeque obsidian to El Chayal during the Late Formative into the Early Classic is also visible at several of the lowland sites listed above as well as at Blackman Eddy. This shift to the primary use of El Chayal obsidian has been argued as being a result of the reorganization of obsidian networks possibly linked to the emergence of the Kaminaljuyu highlands chiefdom during the Late Formative (Fowler et al. 1989; Hurtado de Mendoza 1989; Michels 1976; Nelson 1985). However, this shift is not felt equally throughout the Lowlands as a whole suggesting a more complex set of variables may account for differential distribution and procurement of obsidian. For example, involvement in different spheres of trade and exchange (not necessarily politically aligned), fluctuating economies, political/social/ religious alliances or allegiances and conflict may account for the differences in procurement and distribution.

A majority (60%) of the Cahal Pech obsidian from the most recent source data, as well as from previous sourcing data (69%; Awe and Healy 1996), is from the El Chayal source which goes against the general trend of obsidian distribution in the Lowlands. A fair representation of obsidian from both San Martín Jilotepeque (20% this study; 31% Awe and Healy 1996 data) and Ixtepeque (20% this study) obsidian is also documented. Similarly, obsidian source analysis of five artifacts (one flake from the Middle Formative, four blade fragments dating to the Late Formative) from the nearby site of Pacbitun, upriver and to the southeast from a tributary to the Macal River, show a similar pattern to the source data from Cahal Pech, with 60% El Chayal and 40% Ixtepeque obsidian. The dominant percentage of

El Chayal at Cahal Pech and also Pacbitun, contrasting with the primary San Martín Jilotepeque presence at Blackman Eddy during the Formative Period, appears to be the result of access to different spheres of trade or involvement in a different redistribution network. The location of Pacbitun — in the hills along a tributary of the Macal River, southeast of Cahal Pech (see Figure 1) — suggests that goods may have been funneled through Cahal Pech and then redistributed to Pacbitun. Analysis of obsidian source data from northern Belize coupled with obsidian data from other lowland sites suggest that geographical location and political/social/religious affiliations may have resulted in differential distribution of obsidian, as will be discussed below.

Provenience data from the northern Belize sites of Colha and Cuello consist of relatively equal amounts of all three major Guatemalan obsidian sources, as well as a significant percentage of Mexican obsidian from Cuello (see Table 3). Sourced obsidian from other northern Belize sites illustrate similar patterns, although the sample sets are much smaller and may not be representative of the complete regional obsidian assemblage. Overall, Dreiss suggests (1989) that access to obsidian from all of these sources during this time may be a reflection of the favorable geographic location in close proximity to established coastal networks, as appears to be the case at Colha and Cuello. In addition, through examination of trace element data and development of a regionalized distribution model for the Belize periphery, Dreiss' (1989) also suggests that acquisition of obsidian and resulting patterns of distribution were possibly linked to exposure of Tikal's sphere of influence. Furthermore, communities strategically located near established trade routes, such as Blackman Eddy's location near probable riverine routes, may have participated in the network as "minor-redistribution nodes." Blackman Eddy's role as a "minor-redistribution node" may be directly tied to the accumulation of wealth — evidenced archaeologically in both artifactual and architectural data — and may have contributed to its emergence as a "seat of power" during the Middle to Late Formative Period in the valley.

Through analysis of available obsidian source data, patterns of episodic exploitation of particular obsidian sources during the Formative Period into the Early Classic Period have been revealed by fluctuating frequencies and differential distribution of obsidian thus providing a base for a diachronic reconstruction of obsidian trade networks (Awe et al. 1996; Dreiss 1989; Dreiss and Brown 1989; Rice 1984, 1985). The dynamic nature of obsidian trade and exchange networks evident archaeologically and chemically has precipitated curiosity regarding differential access and distribution, the nature of emerging economies, the catalytic role of trade in internal organization, and centralized control of the obsidian sources. Thus far, the available trace element data in the Maya Lowlands has contributed a great deal to the study of inter-regional trade and exchange networks. The source data from Blackman Eddy and Cahal Pech greatly increase the data set of sourced obsidian for the Belize River Valley and for the Lowlands as a whole. However, as some queries were answered in this study, unique patterns of obsidian distribution in the valley have raised more questions regarding the nature and dynamism of Formative period trade and exchange.

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Obsidian Bifaces of the Eastern Sierra: The Portuguese Bench and Cactus Flat Biface Cores

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Introduction

Recently a number of us (AG, JB, and CS) authored a study on a remarkable cache of 26 obsidian bifaces collected at Little Lake in eastern California (Garfinkel et al. 2003). While making a formal presentation discussing the cache at the Maturango Museum in Ridgecrest, a collector approached the senior author and said that he had a similar biface to those in the Little Lake cache in his possession. He indicated his wish to donate the specimen to the Museum. This provided us with an opportunity to study this new biface. It had been discovered in the vicinity of Portuguese Bench, and collected from a surface context between Fine Canyon and Portuguese Canyon at an elevation of 4300 feet on the eastern scarp of the Sierra Nevada.

Later, a second biface came to our attention: it was collected by Thomas Chapman in 1961, over 45 years ago. That artifact was also found lying on the surface of the ground. This biface however was recovered near the Cactus Flat obsidian source, a subsource within the Coso Volcanic Field. It was discovered at the Cactus Flat village site (CA-Iny-274) at an elevation of about 5,000 feet.

For this study, Craig Skinner, of the Northwest Obsidian Laboratories provided the hydration analysis and sourcing analysis via chemical characterization for both bifaces.

Portuguese Bench Biface

The first biface specimen is a massive core, one of the largest ever recovered in the region. The Little Lake cache specimens were large but this specimen is even more massive. The biface weighs more than twice as much as the heaviest biface in the Little Lake group (see Table 1). As with those in the Little Lake cache, this is a biface core made on a flake. The biface appears to be manufactured with a hammerstone based on some of the observed flake scars. A ventral remnant is found on the dorsal surface of the flake indicating that the preform flake was removed from a larger flake. The ventral remnant is covered with scratches. These may indicate that the original, larger flake was carried in some type of bag with items that could scratch the flake prior to it being spalled or sectioned. The preform flake was removed in a different direction than that of the original flake from which it was detached. Three to four major flake removals occurred on both the dorsal and ventral faces of the flake/biface. Edging (platform positioning) is exhibited on both biface faces and is most pronounced on the ventral side. The ventral face (dorsal surface of original flake) retains a very flat old weathered surface exhibiting pitting. This old surface covers about 20% of the current ventral face of the flake/biface.

The biface was quarried at West Sugarloaf Mountain, a subsource of the Coso obsidian source cluster located in the Coso Range of eastern California within the confines of the China Lake Naval Weapons Station north of Ridgecrest. The obsidian hydration measurement reading obtained for the artifact was 4.1 microns.

A revised lowland Coso hydration rate equation,

Y=659.21 - 516.04x + 155.02x squared - 4.56x cubed

was proposed by Basgall and Hall (2000). This equation translates the micron reading of the biface into an age within the Haiwee Period (A.D. 600-1300, 3.7-4.9 microns) of ca. AD 1115 or 835 uncalibrated radiocarbon years before present.

Onken (2001:117) recently proposed an alternative source and temperature specific lowland Coso hydration equation for the Coso Volcanic Field that provides calendar dates based on calibrated radiocarbon determinations and associated suites of Coso hydration measurements. That equation is 24.45 µm squared/1000 years and provides a calendar date of ca. AD 1263 or 687 years before present (present = AD 1950). The age provided by that rate is very close to those of the Basgall and Hall (2000) equation (as reported above).

Figure 1. Portuguese Bench Biface – ventral face.

The only known location within the Coso aboriginal quarries that has hydration rims of this small size is Maggie's Site (Elston and Zeier 1984; Garfinkel et al. 2003; Gilreath and Hildebrandt 1997). As with the Little Lake cache, the biface was, most likely, quarried from this general area; mining of this areas is indicated by bench and pit mines. It is quite curious that aboriginal flint knappers should have been quarrying such large and massive biface cores so late in time. During the period, when both the Portuguese Bench biface and the Little Lake cache were manufactured, arrow points were exclusively in use. Most eastern California researchers have consistently averred that by this date big biface cores were on the wane and had been replaced by expedient flake tools often scavenged from earlier materials. In the eastern Mojave it has been noted that chert bifacial cores become reduced in size after the advent of the bow and arrow (Binning et al. 1986:175, 2004:5). Perhaps changes in the character of biface-core use over time are in need of re-examination.

Figure 2. Portuguese Bench Biface – dorsal face.

Cactus Flat Biface Core

The Cactus Flat specimen is a more reduced and finished biface core than any of the Little Lake or Portuguese Bench artifacts. This percussion biface was thinned with a hammerstone. Six major flake removals are evident on the ventral face and eleven on the dorsal face of the core. Edging (platform positioning) is exhibited on both faces and is most pronounced on the ventral face. Three flake scars run almost completely across the entire face of the biface (nearly an outrepassé or overshot flake was removed), two on the dorsal side of the biface and one on the ventral. This approach to biface reduction has been noted as a technique used by Clovis flint knappers (see Bradley 1991:370; Collins 1999:46; Frison and Bradley 1999:65; Gramly 1999:63, 2004:37; Wilke et al. 1991:265-266). Wilke and his colleagues have noted that part of an overall pattern for Clovis age lithic reduction is:

> "…the detachment by percussion of thinning flakes from one margin of the biface and stopping them at the other margin with maximum efficiency and minimum loss of material or symmetry through overshot…" (Wilke et al. 1991:266).

The Cactus Flat biface core is also consistent with other elements of the Clovis pattern in being a relatively large bifacial core of oval or leaf shape. Besides the overall morphology of the Cactus Flat artifact, also the length, width, and thickness of the biface compare favorably with several "Clovis point blanks" that were part of the Anzick site Clovis cache from Montana (Wilke et al. 1991: Figures 3, 4, and 6). Those bifaces similarly exhibited a minimum number of flake detachments with a minimum loss of useful toolstone. The Cactus Flat artifact would be considered as a "late middle" stage biface when compared to the other recently discussed Coso bifaces (Little Lake and Portuguese Bench) that represent earlier stages in the reduction sequence.

It was anticipated that this biface would have originated from the nearby Cactus Flat or Sugarloaf Mountain obsidian sources. Hence it was a great surprise to have determined that the biface actually was manufactured from Bodie Hills obsidian. That source is about 130 miles to the northeast of the discovery site. Such a determination is improbable but not impossible as artifacts of exotic obsidians occasionally turn up in prehistoric sites in the Coso Volcanic Field. For example, artifacts made from Casa Diablo obsidian, a source near Mammoth Lakes, California, have routinely been identified within the Coso region. The Casa Diablo source is located 150 miles north of the Coso area.

A surprisingly large obsidian hydration measurement of 8.8 microns was obtained for the Cactus Flat biface. One of us (CS) has developed a database of obsidian hydration measurements for Bodie Hills' obsidian artifacts and out of 1,018 hydration measurements only ten are larger than this rim (Craig Skinner personal communication 2006). Rosenthal and McGuire (2004) have completed the most ambitious and extensive study evaluating the rate of hydration rim development for Bodie obsidian. They suggest their "Model C" as most compatible with current radiometric dates and the associated suites of obsidian hydration measurements. That power function equation produces calibrated radiocarbon ages (calendar dates) that best fit the current data (Rosenthal and McGuire 2004:124).

That equation is: $Y=86.021x^{2.28}$

"Y" equals the age in calibrated radiocarbon years before present and x equals the number of microns, with the present equal to AD 1950. Using their lowland rate equation, developed for sites of nearly similar elevation (4,000 feet or less), a calendar date of 12,280 cal BP was calculated based on the 8.8 micron rim size. The upland rate, if applied, would produce a far greater and unreasonably ancient age.

The early age and exotic location for the Cactus Flats obsidian biface core is consistent with, what some have suggested are, the mobility patterns of late Pleistocene hunter-gatherers. Recent research (Jones et al. 2003) suggests that during the Paleoindian Period the early occupants of the central Great Basin traversed very large subsistence areas with extensive foraging ranges. In alignment with that model are mobility tactics requiring moves of up to 400-km north south and 100-km east west.

During the late Pleistocene, effective moisture was greater than in any subsequent interval in the prehistory of central Nevada and "travelers" (Bettinger and Baumhoff 1982) operated in small groups and had low population densities. According to Jones et al. (2003), these groups had little competition for resources and made only brief residential stays. They appear to have migrated, on their annual rounds, between resource-rich patches that were rapidly depleted (Bettinger 1991, 1994, 1999). Most likely the Cactus Flat biface of Bodie Hills obsidian was procured as an "embedded" activity rather than through formal exchange, although informal reciprocal trade cannot be completely ruled out (Basgall 1989).

Given the obsidian hydration measurement of the Cactus Flat biface it is likely that the artifact is of Clovis age and might be associated with some of the earliest colonizers of the Americas. It has been noted that Clovis assemblages contain large amounts of exotic toolstone (Basgall 1989; Collins 1999:40; Frison and Bradley 1999:65). This may indicate that these hunter-gatherers had limited knowledge of the locations of toolstone sources (although it has also been argued Clovis people had knowledge of sources of high quality stone) that lay ahead of them during their moves across the landscape. They did this to ensure that they carried ample high quality toolstone with them in the form of portable bifacial cores. Such would seem to be the case in the present instance in which Bodie Hills obsidian was carried 130 miles from its source to another location containing ample high quality volcanic glass-- the Coso Volcanic Field.

Figure 3. Cactus Flat Biface – dorsal face.

Conclusion

The two bifaces discussed here reflect behavior from two very disparate time periods. The Portuguese Bench biface core fits well with the Little Lake cache discussed in our previous report. As with the Little Lake cache bifaces it is an early stage biface exhibiting limited evidence of reduction. The biface was most likely intended as a handy package of toolstone useful in the production of informal flake tools and arrow points. The Little Lake cache and the Portuguese Bench biface core have similar hydration rim measurements that date to the very end of the Haiwee Period or the earliest years of the Marana era (ca. AD 1100-1400). The later stage Cactus Flat biface is a result of human behavior that occurred 12,000 years ago or earlier.

The only commonalities of these two bifaces are 1) both were found in the Coso area and 2) both are percussion bifaces made of obsidian. The Cactus Flat biface was originally quarried 130 miles to the northeast and carried to the Coso area. The stage of the Cactus Flat biface suggests that further thinning and finishing occurred in the interim. Once the biface was brought to the Coso Range, the hunter-gatherers found themselves in an area with a wealth of obsidian. In this context, the value of the biface diminished and thus it was discarded. Obsidian toolstone could now be quarried and made into bifacial cores to meet future needs. Finally, the Cactus Flat biface exhibits many characteristics in overall morphology and reduction strategy and is similar in age to those found in Clovis contexts.

It is obvious that much remains unknown and perhaps unknowable regarding the aboriginal activities in the Coso region both in the late Pleistocene and the more recent past. Nevertheless, the obsidian artifacts scattered about the landscape compel our attention and interest and provide us with insight into both unique and common behaviors of past hunting and gathering cultures of the Coso region. This is certainly true of the two artifacts discussed here.

Table 1. Comparison of Obsidian Biface Cores from the Eastern Sierra

Portugese Bench Biface				
Hydration measurement and age: 4.1± .2; 835 rc years bp; ca. AD 1115 (Basgall & Hall 2000 rate) 687 cal. yrs bp; ca. AD 1263 (Onken 2001)				
Length	210			
Width	120			
Thickness	50			
Weight	1065 g			
Source: West Sugarloaf Mountain (Coso)				
Little Lake Biface Cache				
Mean hydration measurement and age: 3.8 ± .2; 686 rc years bp; ca. AD 1264 (Basgall & Hall 2000 rate) 590 cal. yrs. bp; ca. AD 1359 (Onken 2001)				
	Range	Mean	S.D.	C.V.
Length	117-160	139	11.4	.08
Width	77-94	85.4	4	.05
Thickness	22-40	30.9	4.6	.15
Weight	243-529	348	68.6	.2
Source: West Sugarloaf Mountain (Coso)				
Summary: N =27; Hydration Range: 3.5-5.6 microns; Mean = 3.8; S.D. .37; CV .09				
N =26 (all complete bifaces with fragmentary outlier removed) Hydration Range: 3.5-3.8 microns; Mean 3.7; S.D. .07; CV .01				
Cactus Flats Biface				
Hydration measurement and age: 8.8± .2; 12,280 cal. years bp; ca. 10,330 BC				
Length	182			
Width	74			
Thickness	15			
Weight	268 g			
Source: Bodie Hills California				
Key: S.D.= Standard Deviation, C.V.= Coefficient of Variation, N= Sample Size, Cal. = calibrated, bp = before present (AD 1950), rc = radiocarbon				

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Jemez Mountains Obsidian Source Database Project

The Valles Caldera National Preserve and University of New Mexico are developing a database to compile the occurrence of Jemez obsidian artifacts in archaeological assemblages throughout North America. We are seeking projects and reports where geochemical sourcing has established obsidian material provenance from various Jemez Mountains geological sources (located in northern New Mexico).

The more commonly found Jemez obsidian sources are known variously as Cerro del Medio/Valle Grande (Valles Rhyolite), Obsidian Ridge/Rabbit Mountain (Cerro Toledo Rhyolite) and Polvadera Peak (El Rechuelos Rhyolite). Other source names include Bear Springs, Bearhead Peak, Canovas Canyon, Cerro Pavo, Cerro Rubio, etc. We are interested in all of these, and are particularly seeking evidence of Jemez obsidian artifacts in assemblages located far away from the original source area.

We need your help to make the database as comprehensive as possible. If you know of projects, articles, or reports that discuss sourcing of obsidian artifacts from Jemez Mountains sources, please contact Ana Steffen, VCNP Cultural Resources Coordinator (asteffen@vallescaldera.gov or 505-428-7730), or Phil LeTourneau (plet@unm.edu).

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